Seawater Air Conditioning for Hawaii

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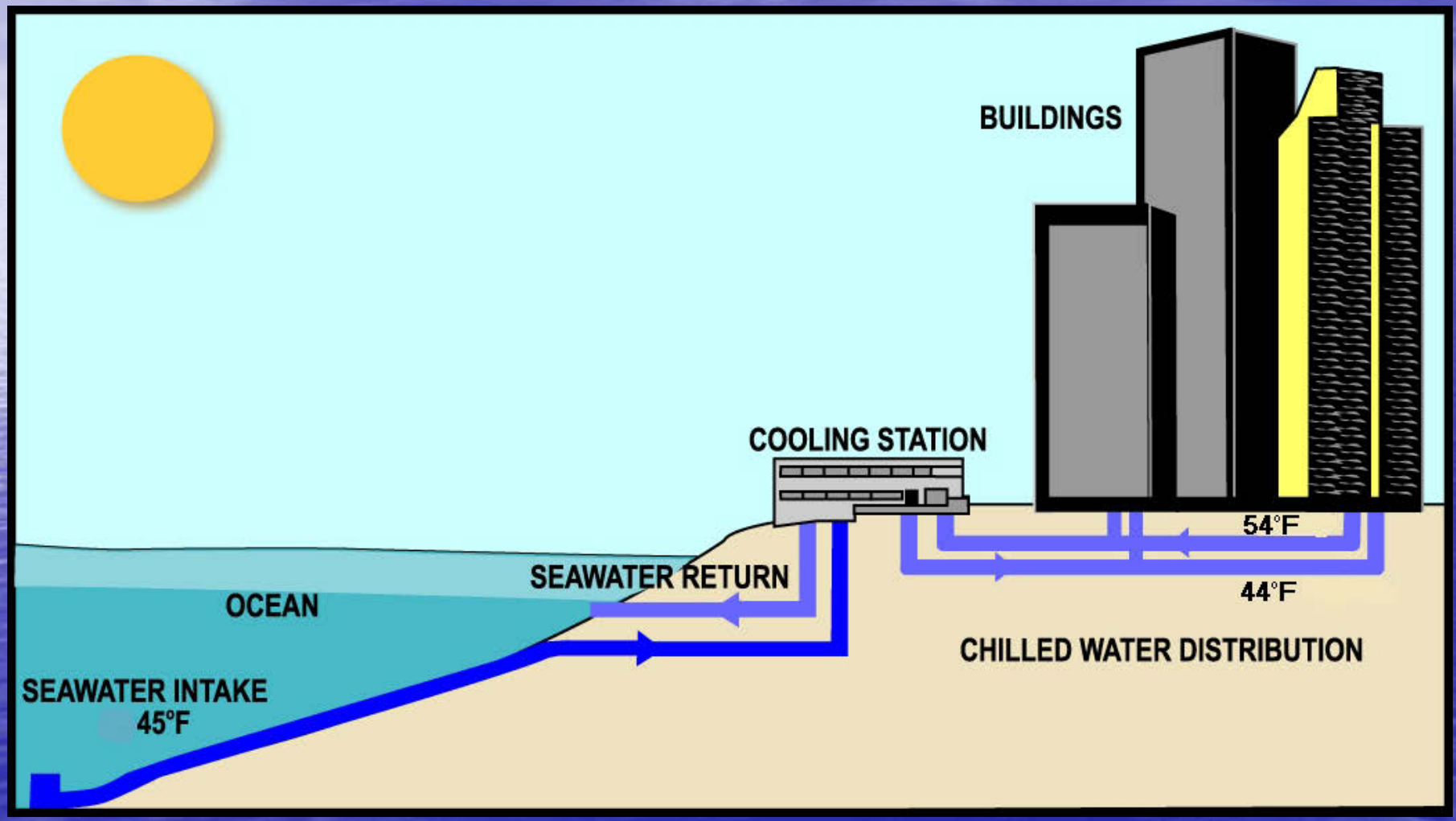
Presentation Overview

- Seawater Air Conditioning for Hawaii
  - What It Is
  - Why Its Needed
  - Benefits of SWAC
  - Where We Are
  - How HEPF Can Help

What is SWAC?


BUILDINGS
COOLING STATION
54°F
44°F
SEAWATER RETURN
OCEAN
CHILLED WATER DISTRIBUTION
SEAWATER INTAKE
45°F

WORKING TOGETHER, LET'S CAPTURE THE OCEAN'S POWER IN OUR ENERGY MIX.

$3 billion dollars a year leave Hawaii to pay for imported oil to power our cars, jet planes and boats -- and to generate electricity.

We owe it to ourselves, to our children and grandchildren to make ocean energy a major part of Hawaii's future.

HOW DO WE **POWER OUR FUTURE?**

ONE ANSWER LIES IN THE OCEAN ALL **AROUND US.**

THE OCEAN'S **POTENTIAL**

The ocean is a vast energy storehouse. Technologies being tested and implemented around the world could tap this virtually endless source of renewable energy. The waters around Hawaii hold great promise for many of these technologies.

SEA WATER AIR CONDITIONING (SWAC)

Air conditioning is among the largest, and fastest growing, use of electricity in Hawaii homes and businesses. With SWAC, cold sea water is pumped from hundreds of feet below the surface to a cooling station on shore. Here the deep ocean's coldness is transferred to fresh water. The cold, fresh water then circulates in a closed pipe that carries it to nearby buildings. SWAC can deliver reliable cooling using far less electricity than conventional air conditioning.

This kind of cooling system is a proven technology, in use at several locations – especially Sweden. Hawaii is a leader in deep sea pipeline development and installation.

Hawaiian Electric supports the SWAC technology proposed by others for downtown and Waikiki and encourages building owners and managers to consider participating. We hope to be among the first to use SWAC in our downtown headquarters.

Why Its Needed - A Solution To Oahu's Energy Crisis

- A Proactive Response to Energy Crises
- Reduces Need for New Fossil Fuel Generation Capacity
- Uses Renewable Energy
- Reduces Hawaii's Dependence on Oil
- Reduces Fossil Fuel Air Emissions
- Saves Potable Water and Reduces Sewage Generation
- Provides Local Economic Development Benefits

Current Energy Crises

- World Oil Crisis
- Reserve Electricity Generation Capacity Crisis on Oahu
- Crisis for Hawaii's Energy Users

World Oil Crisis

- Increasing Demand
- Demand Increasing Faster Than Production
- Excess Production Capacity at Record Lows
- New Discoveries Not Keeping Up With Demand Growth
- Supply Disruptions Due to Geopolitical Events
- Fears of Terrorism
- Weather
- Speculation

Increasing Demand

- Global Demand Now 84 Mbbl/d
  - Nearly 1,000 Bbl/sec
  - 30 Billion Bbl/yr
- Global Demand Increasing by 2%/yr
  - >60% increase by 2030
- China ~ 7%/yr; India ~30% over 5 yr

Demand Increasing Faster Than Production

- After Peak, Production Declines 3 to 6%/yr
- 54 of 65 Largest Producers Past Peak
- 5 More to Peak in Next Six Years
- U.S. Peak
  - Lower 48 in 1970
  - Alaska in Late 1980's
- World Peak
  - 2011

Excess Production Capacity at Record Lows

- 2006 ~ 1Mbbl/d
- ~ 1% of Demand
- Major Producers Already Pumping as Fast as They Can

New Discoveries Not Keeping Up With Demand Growth

- U.S. (Lower 48) Discovery Peak – 1930's
- Global Discovery Peak – 1960's
  - 1960's – 47 Bbbls/yr
  - 1970's – 35 Bbbls/yr
  - 1980's – 24 Bbbls/yr
  - 1990's – 14 Bbbls/yr
  - Recent → 4 Bbbls/yr
- Profits Going to Acquisitions and Shareholders – NOT to Exploration

Supply Disruptions Due to Geopolitical Events

- Many Trouble Spots
- Many Are Major Oil Producers
  - Venezuela; Russia; Nigeria; Saudi Arabia; Iran; Iraq; …
- Wars Over Oil in Past – Likely in Future

Fears of Terrorism

- Attacks on Oil Personnel and Facilities
  - Nigeria; Saudi Arabia; Iraq
- "Terror Premium" = $5 to $7/Bbl (Some say much more)

Weather

- Gulf of Mexico
  - Source of Much of U.S. Oil
  - Site of Significant Refinery Capacity
- Record Number of Hurricanes in 2005
  - Likely to Increase With Global Warming
- Supply Disruptions
  - Hurricane Ivan
  - Hurricane Katrina

Speculation

- Yes – Of Course
  - Something Other Than Production Costs
    - Average World Wide Production Costs - $5/Bbl
    - OPEC - $1.50/Bbl
  - Current Price ~$60
- Oil Prices Convey the "Market's Evaluation of Scarcity"
- Oil Becoming Scarcer and More Valuable

Bottom Line

- High Oil Prices are Here to Stay
- Much Higher Prices are Likely in the Future

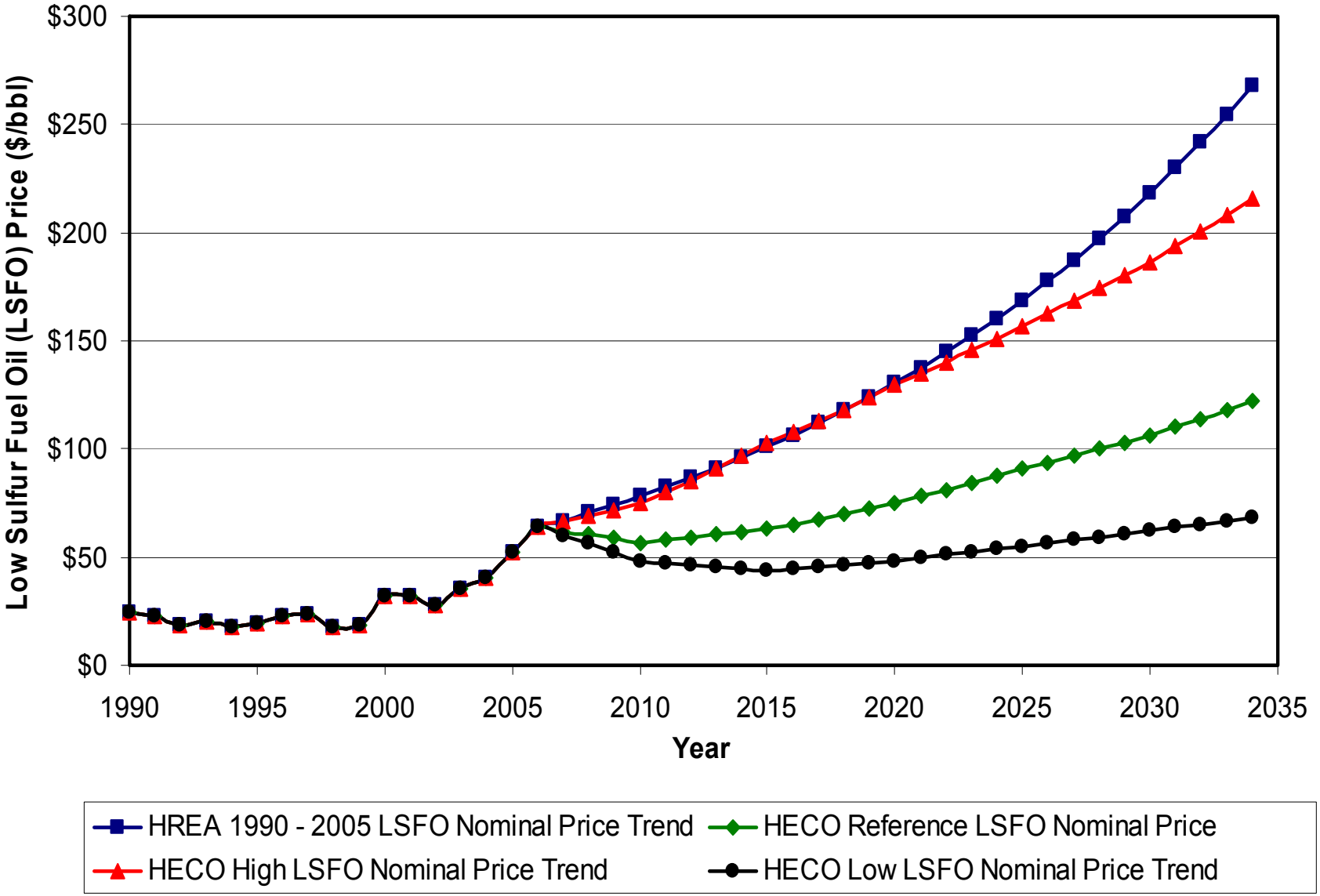
Reserve Electricity Generation Capacity Crisis on Oahu

- HECO Has a Reserve Capacity Crisis
- Next Power Plant – 2009 (at the Earliest)
  - Opposition and Permitting May Delay This
- What Can We Do?

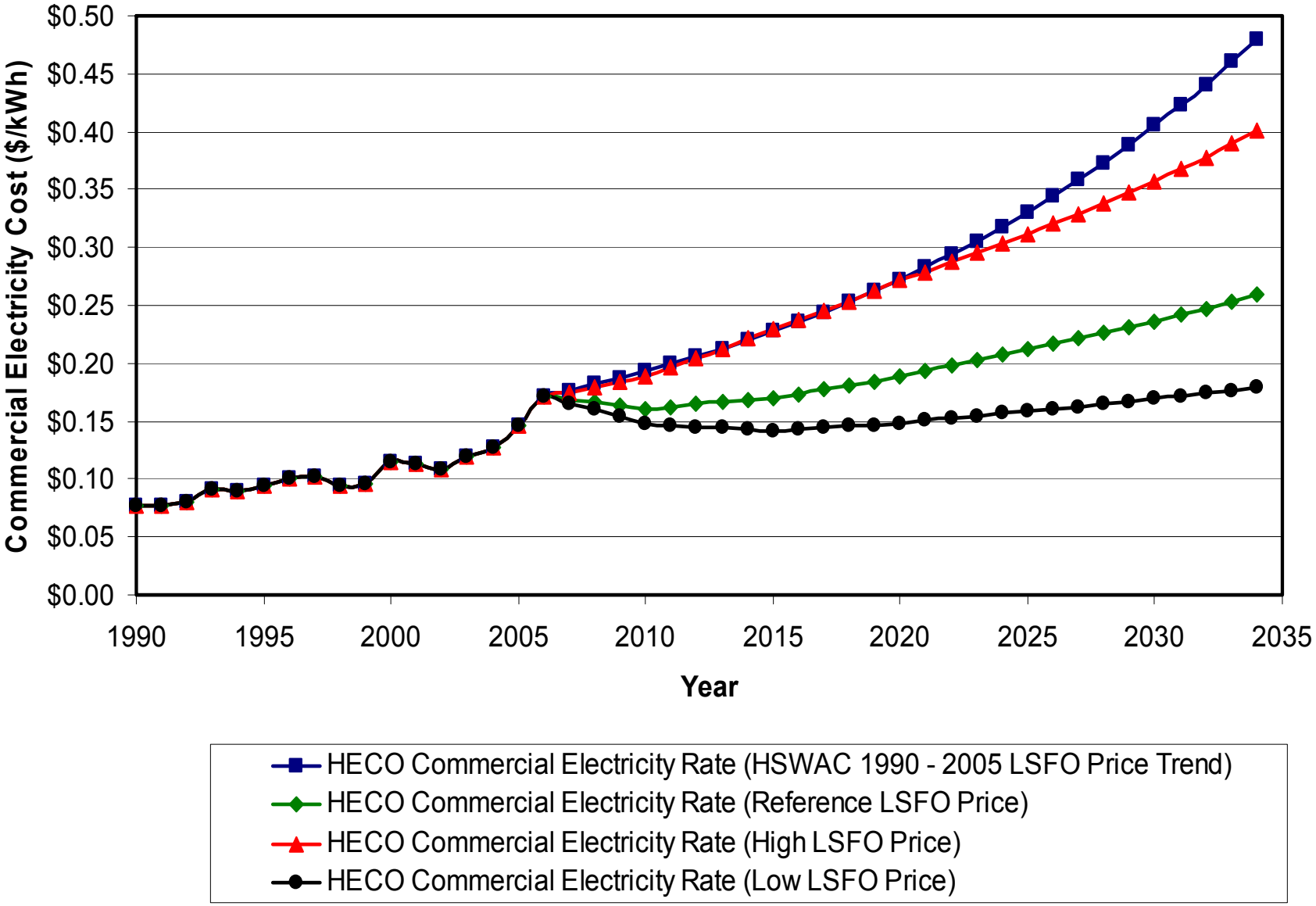
Crisis for Energy Users

- Increased oil costs leading to increased electricity prices
- Increased energy costs mean less for other needs

LSFO Prices - Historical Prices and Price Trends (1990 - 2034)



HECO Commercial Electricity - Historical Rates and Trends (1990 - 2034)



Benefits of SWAC to Hawaii

- Demand Side Benefits
- Increased Use of Renewable Energy
- Environmental Benefits
- Economic Development

Demand Side Benefits

- Reduces Need for New (Likely-to-be-fossil-fueled) Generation Capacity
- 100,000 tons of SWAC will Displace Up to 63 megawatts of New Generation
  - Equal to 86,000 Solar Water Heating Systems
  - Equal to ~4 years of HECO's Load Growth

Demand Side Benefits (cont'd)

- Each ton of SWAC eliminates the need for more than 3,400 kWh/year of energy use
- 100,000 tons of SWAC will save 344 million kWh/year
- Equal to more than 123,000 residential solar water heating systems.

HECO's Total DSM Program Costs – With and Without SWAC

Case	Net Present Value of Total Program Costs	Net System Energy Savings	Net System Peak Demand Savings	Net Present Value Cost	
Units	million $	million kWh	MW	$/kWh	$/kW
HECO's Baseline DSM	**221.6**	**559.9**	**157.6**	**0.232**	**581**
HECO's Baseline DSM + 25,000 tons of SWAC	**229.1**	**605.8**	**164.2**	**0.225**	**563**
HECO's Baseline DSM + 100,000 tons of SWAC	**240.6**	**768.9**	**184.3**	**0.196**	**489**

Marginal Costs of Adding SWAC to HECO's DSM Programs

Case	Increase in Net Present Value of Total Program Costs	Increase in Net System Energy Savings	Increase in Net System Peak Demand Savings	Marginal Cost	
Units	million $	million kWh	MW	$/kWh	$/kW
HECO's Baseline DSM + 25,000 tons of SWAC	**7.4 (+3.4%)**	**45.9 (+8.2%)**	**6.7 (+4.2%)**	**0.119**	**297**
HECO's Baseline DSM + 100,000 tons of SWAC	**18.9 (+8.5%)**	**209.1 (+37.3%)**	**26.7 (+16.9%)**	**0.069**	**172**

Increased Use of Renewable Energy

- Uses an Abundant, Indigenous, Renewable Energy Resource
  - 22 billion year supply
- Helps Meet Renewable Portfolio Standard (RPS) Requirements

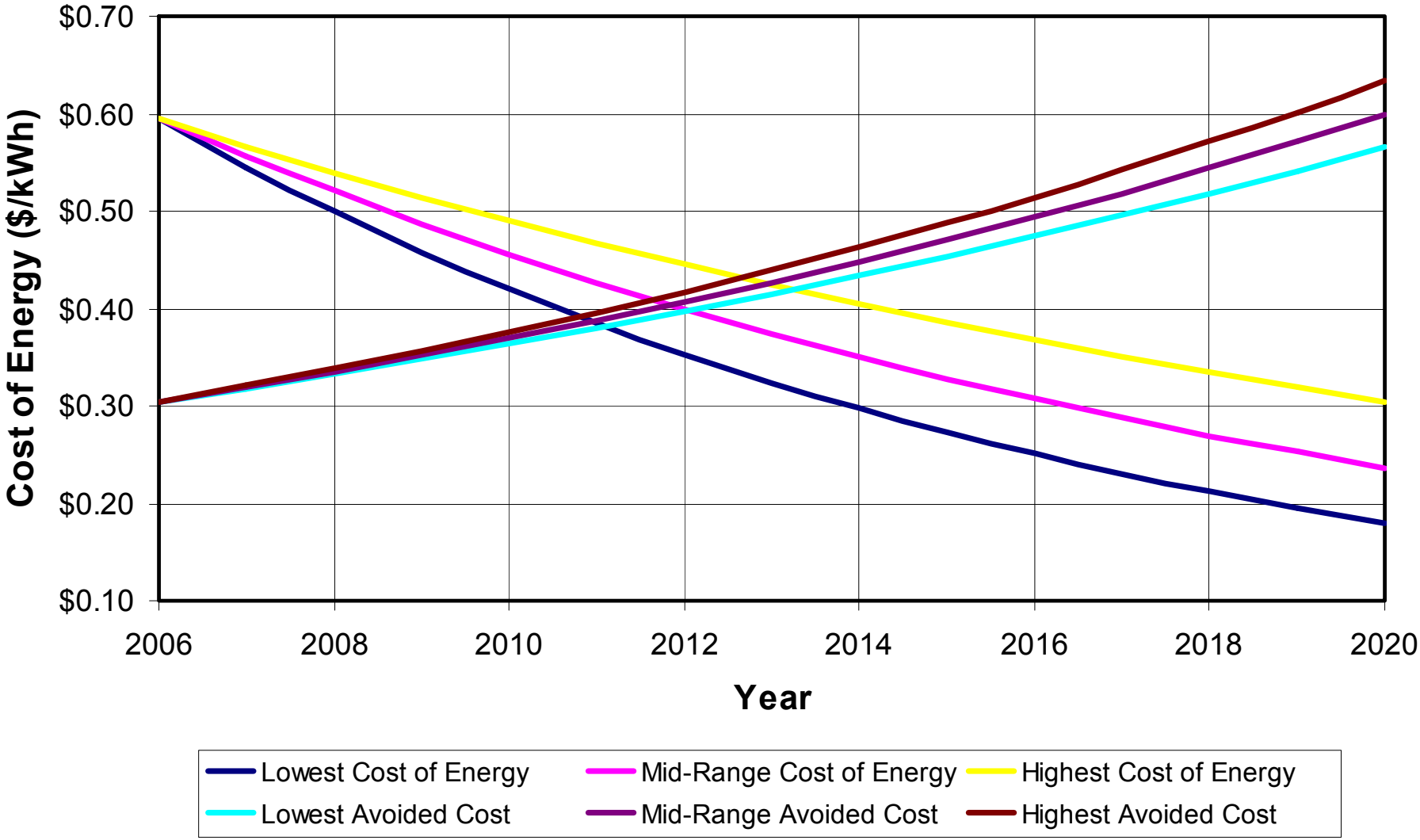
Increased Use of Renewable Energy (cont'd)

- 100,000 Tons of SWAC Will Provide Renewable Energy Benefits Equal to:
  - 187 MW of Photovoltaics
  - 123 MW of Wind
  - 60 MW of MSW Combustion

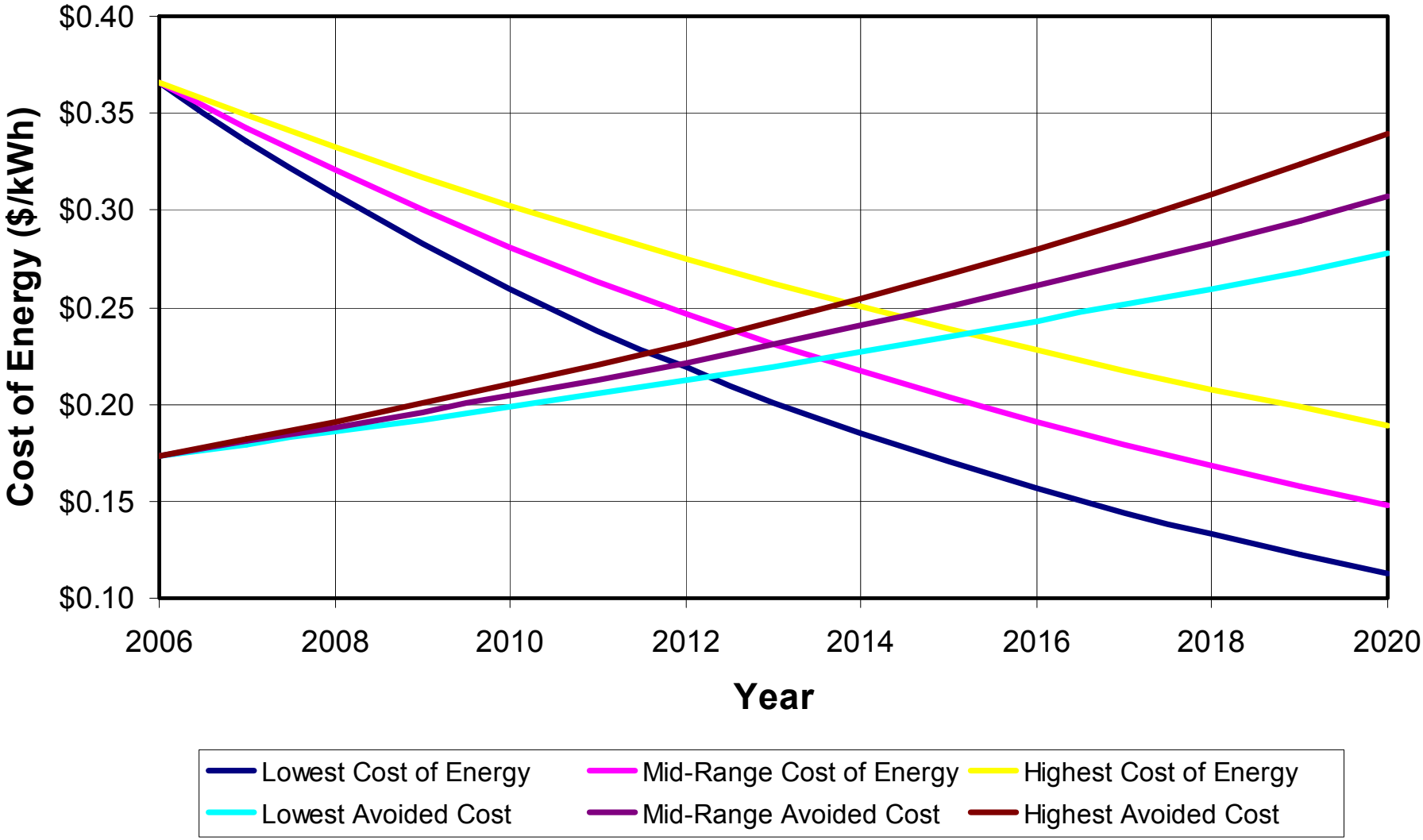
Renewable Energy Development

- Near-Term (0 – 5 years) (2006 – 2010)
  - Solar Thermal (Water Heating/Process Heat)
  - Wind
  - SWAC
  - Biomass (MSW & Co-Firing? & Biofuels?)
- Mid-Term (5 – 10 years) (2010 – 2015)
  - Wave
  - Residential Utility-Intertied PV on Neighbor Islands
  - Commercial-Scale PV
  - OTEC (5 – 10 MW module)
- Long-Term (10 – 20+ years) (2015 – 2025+)
  - OTEC (100 MW)
  - Residential Utility-Intertied PV on Oahu
  - Utility-Scale PV?

Learning Curve Analysis for Residential Photovoltaics on Kauai



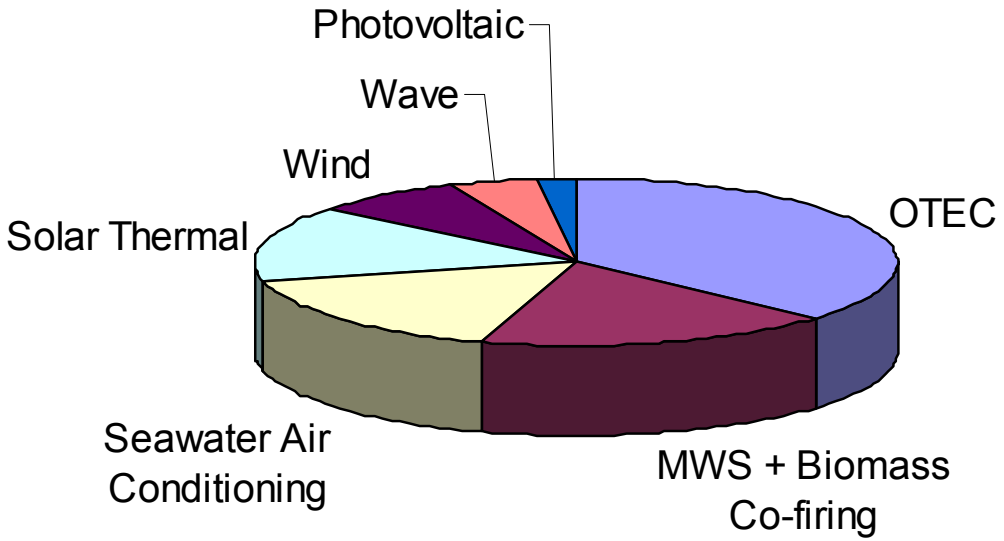
Learning Curve Analysis for Commercial-Scale Photovoltiacs on Oahu



SWAC's Impact on Hawaii's RPS

Renewable Energy Potential on Oahu
Projected for 2020

SWAC provides one-sixth of the 20 percent renewable energy requirement of the Oahu RPS



Renewable Energy Potential on Oahu

Technology	Annual Production (Million kWh/yr)	System Size (MW)	Capacity Factor	Fraction of Oahu Renewables (%)
OTEC	701	100	0.80	36.8
MSW + Biomass Co-firing	342	60	0.65	17.9
Seawater Air Conditioning (SWAC)	319	100,000 Tons	0.52	16.7
Solar Thermal (SWH)	280	100,000 Systems	-	14.7
Wind	140	50	0.32	7.4
Wave	88	25	0.40	4.6
PV	37	20	0.21	1.9
Totals	1,906	-	-	100.0
Oahu Use	9,348	-	-	-
RE as % of Oahu Electricity Use	20.4	-	-	-

Environmental Benefits of SWAC

- Reduces the Annual Use of Imported Fossil Fuels by More Than 777,000 Barrels
- Reduces Associated Power Plant Emissions

Environmental Benefits of SWAC
(cont'd)

- Eliminates Cooling Towers
  - Reduces Potable Water Use
    - 1.3 billion gallons per year
  - Reduces Sewage Generation
    - 500 million gallons per year
  - Eliminates Need for Water Treatment Chemicals

Local Economic Development Benefits

- Will Generate Millions Of Dollars In Construction Project Spending
- Long-term, Well-paid Jobs Also Created
- Local Economic Development Benefits Accrue from Money that Stays in Hawaii, and Not Used to Purchase Oil

Where We Are

- Significant Progress Has Been Made
- System Design
- Environmental Impact Assessment and Permitting
- Financing
- Customer Marketing
- Projected Startup Date – Early 2009

How HEPF Can Help

- Incorporate SWAC Into State Energy Planning
- Assist in Public Education Efforts
- Support SWAC-Related Legislation
  - Special Purpose Revenue Bonds
  - Inclusion in Enterprise Zones
  - Non-Exclusive Franchise/Easements
  - Priority Processing of State Permits

Aloha!